

## ABSTRACT OF THE INVENTION

Apparatus and method for converting hydrocarbon fuels to hydrogen-rich reformate that incorporate a carbon dioxide fixing mechanism into the initial 5 hydrocarbon conversion process. The mechanism utilizes a carbon dioxide fixing material within the reforming catalyst bed to remove carbon dioxide from the reformate product. The bed optionally contains a water gas shift catalyst. The removal of carbon dioxide from the product stream shifts the reforming reaction and shift reaction equilibria toward production of higher concentrations of hydrogen with 10 only small amounts of carbon oxides produced. The carbon oxide-depleted reformate is directed to a purification bed comprising a hydrogen fixing material that removes hydrogen from the reformate stream to provide fixed hydrogen and a hydrogen-depleted reformate that flows out of the purification bed. The purification bed is heated to release fixed hydrogen from the hydrogen fixing material to provide a 15 highly pure hydrogen gas.